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GB 1507684
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(54) **Control of broadcast radio and television receivers**

(57) A television or, as shown, radio receiver (10) is provided with a light pen (12) capable of reading bar codes in a broadcasting periodical (18), these codes then being applied to a store (30) in the receiver. The programme codes comprise a station reference number and a time indication. When the time approaches, the station reference number is addressed in a frequency directory (34) and the corresponding frequencies located. A detector (42) determines which of the frequencies provides the strongest signal. In the absence of a frequency in the directory, or in response to manual actuation of a button (50), the tuning is successively swept across the entire tuning range and signalling carried by the radio signal is detected (48). These signals may include information characteristic of the station and of the transmitted programme, i.e. a channel code and a time code. The time code is compared (36) with the stored programme time and an alarm (60) activated. If a button (62) is depressed, the receiver A.F. circuits (24) are de-muted, but if the button is not depressed the programme is recorded (64). Frequency information can be directly entered into the directory (34) using the light pen (12).

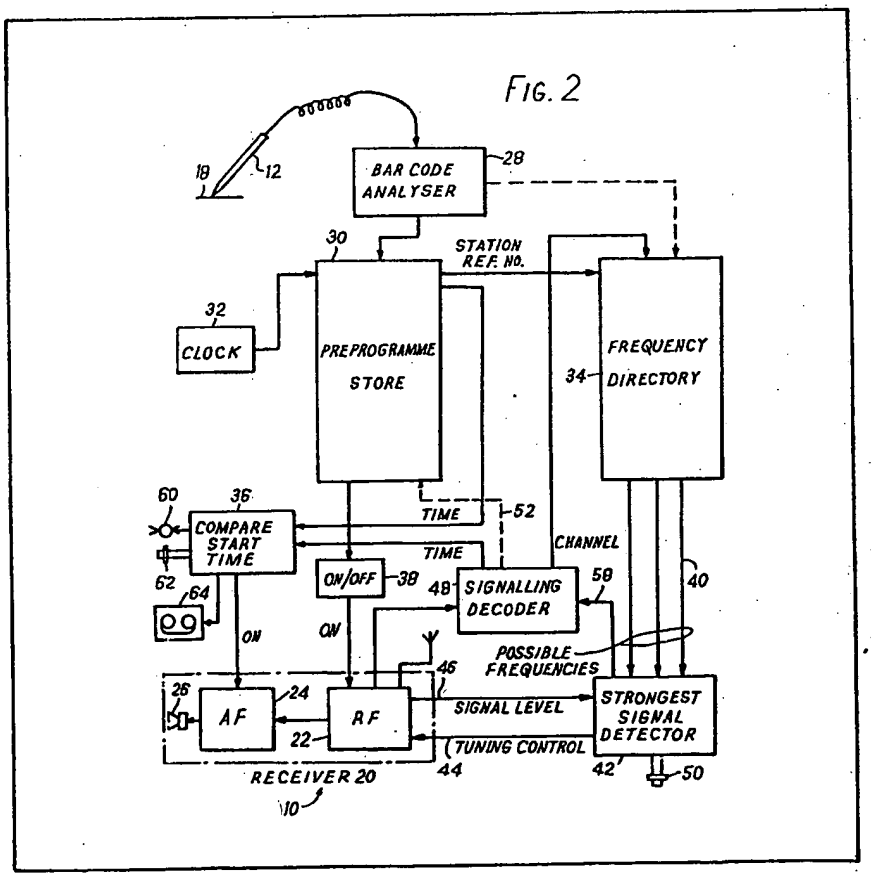

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FIG. 1

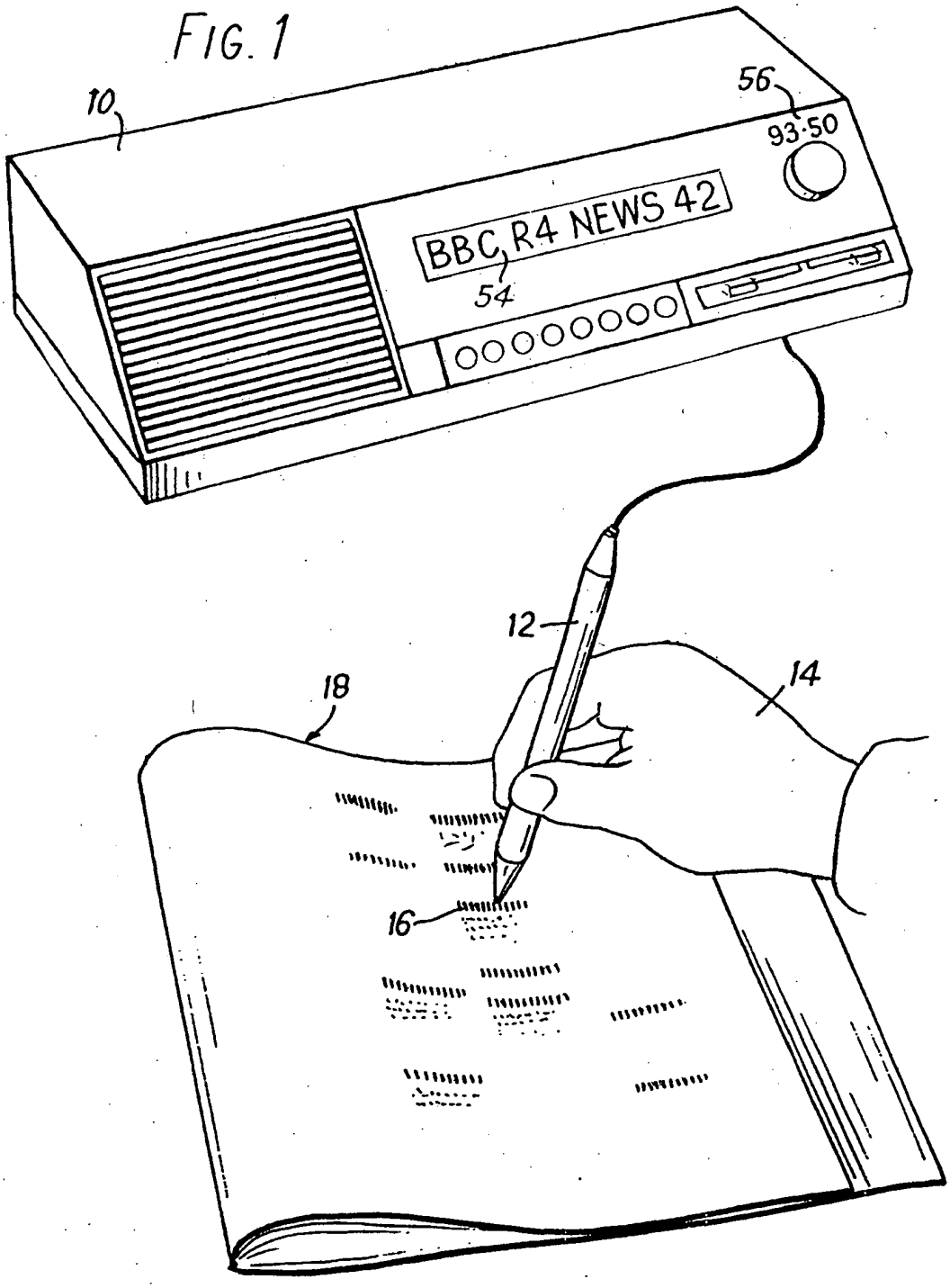

FIG. 3  16

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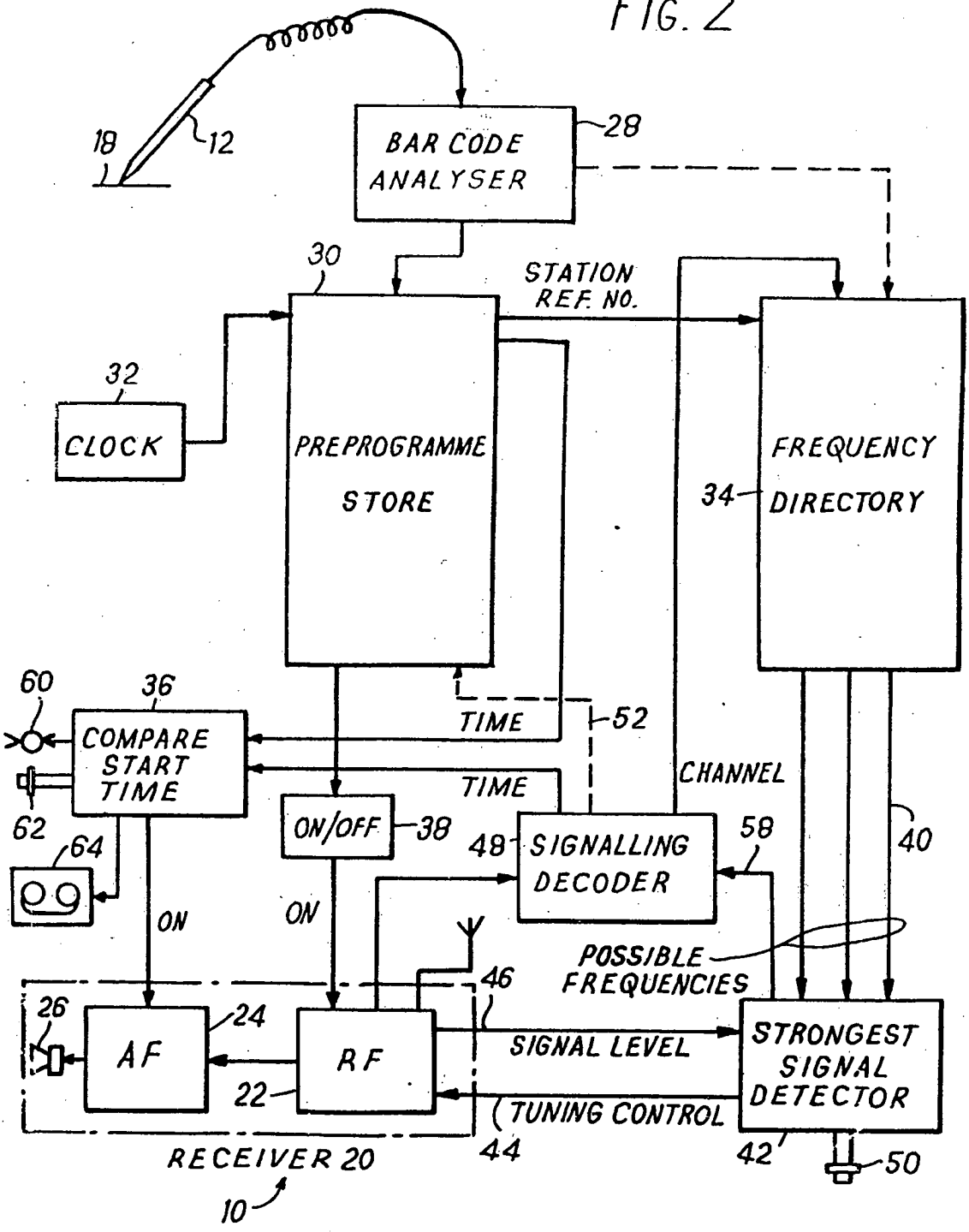
FIG. 2



SPECIFICATION

Improvements relating to broadcast radio and television receivers and to the control of such receivers

This application relates to broadcast radio and television receivers and to the control of such receivers.

In this specification when we use the term "receiver" we mean a radio or television receiver suitable for receiving broadcast transmissions.

There is a desire, if not to say a requirement, for a receiver which can present to receive particular programme frequencies or channels at specified future times and dates up to, say, ten days ahead. Owners of such receivers would be able to pre-programme their listening or viewing for all the programmes which they did not want to miss during a whole week. They would, for example, refer to the broadcasting periodical, such as the *"Radio Times"*, on the day it is published and enter data into the receiver for each programme required. Alternatively, the pre-programming could be set up daily, or even just an hour or two in advance. In the broadcasting periodical, against each programme could be printed a string of digits which the user would enter into the memory in the receiver by means of a keypad. A check digit could be used to reduce the likelihood of errors going unnoticed. The Braille version of the broadcasting periodical could carry the equivalent digit string in Braille-coded form.

A considerable number of prior proposals for pre-programmable receivers have been made, as may be seen from US Patents 4,088,958; 4,081,754; 4,031,470; 4,004,085; and 3,800,230, and a paper by N. KOKADO and others published in *I.E.E.E Transactions on Consumer Electronics* Vol 22, No 1, Febuary 1976, pages 69-83 and entitled "A Programmable TV Receiver".

Despite all this effort, no satisfactory system has yet materilised. A major problem with such a system is the difficulty of pre-programming it accurately for a large number of programmes. Each item would need something like twelve numeric or alphanumeric characters to specify date, time and programme channel or frequency. There is thus a problem for the user of working out the character or digit string necessary to achieve the correct pre-programming function for each programme. Also, with several long character strings, the time taken to enter them via a keyboard would be significant.

Many potential users would be unable to carry out these processes without errors occuring.

With a view to overcoming these problems it has been proposed to present information to a receiver in a machine readable form, by means of a strip which is inserted into the receiver, see German Laid-Open Applications (Offenlegunsschriften) 2030034 and 2445520. In practical terms this is also unsatisfactory. It requires mechanical components for driving the strip, and the strip is prone to damage. Furthermore, the programming is still relatively complex; it is not suitable for consumer use.

The present invention is defined in the appended claims, to which reference should now be made.

Our preferred solution to the problem is to print bar-codes in the broadcasting periodical, e.g. *"Radio Times"*. Bar codes represent strings of digits or characters by means of a pattern of stripes or bars. A system employing bar codes which are read by passing of a light pen across the bar code is sold by Plessey Telecommunications Data Systems, Sopers Lane, Poole, Dorset BH17 7ER, England, and comprises a light pen model No 1050 and a label printer model No 2101.

Above or alongside the details for each programme there is printed a bar-code representing the correct string of digits or characters to make the receiver switch itself on correctly tuned to the particular channel at the particular time. Using a light pen attached to the receiver, the "instructions" can be entered quickly and without error.

The programme channel can be an identification specified in terms of frequency, band and channel number, or an identification code. If an identification code is used, the station can be found by "searching" or by reference to a table or "directory" held in a memory in the receiver. The directory gives the frequencies pertaining to each identification code and the receiver selects the frequency which gives the best reception. The directory can be set up by supplementary signals carried by the broadcast radio signal, by a "learning process" from previously used stations, or by feeding in data pertaining to the local area. The latter could be obtained from further bar-codes, for example, on "a frequencies in your area" page in the broadcasting periodical or from leaflets containing data in bar-coded form.

"Time" can be standard clock time, but this relies upon the receiver clock remaining accurate and on the broadcasting authority adhering to its schedules. A preferred aspect of this invention overcomes this problem by making use of signalling signals carried in the broadcast radio signal, e.g. on a subcarrier, which identify a "schedule time", ie, the signal will indicate 10.00 a.m. when the 10.00 a.m. programme commences, even if the actual time is say 10.02 a.m. The receiver can then contain a schedule time clock which is kept in step with the transmitted schedule time.

Another possibility is to use programme sequence numbers which can be loosely related to clock time and which can be carried by signalling signals in radio and used rather like Teletext time code. The receiver then searches for the appropriate programme number.

Just before the start of pre-programmed reception the receiver can request its owner to confirm his/her availability for listening or viewing. Failure of such confirmation (or any alternative command) can be used to initiate automatic recording of the programme.

Bar-codes can also be used in T.V. and radio programme guides or timetables given in newspapers

and magazines.

If there is no problem caused by the space occupied for the bar-codes, they can be given for only the more important programmes such as serials or courses where failure to listen or to have the programme recorded would result in greater loss.

"Pop" stations can have give-away bar-codes labels intended for sticking on to the side of the radio. Reading these with the light pen gives instant tuning to the "favourite station" the name of which can be printed under the bar-code.

When not in use, the receiver's light-pen can conviently be kept in a receptable in the receiver's case. There can be a switch to detect when the pen is in use, and then to power the pen and switch any data display, or other output device fitted to the receiver, from its normal use to that of monitoring the data being read by the pen.

A display device can indicate conflicting requests such as trying to listen to two programmes at the same time, or impossible requests such as trying to listen to a programme which has already been transmitted.

The receiver's speaker can be used to issue, for example' one "bleep" to confirm correct entry of a code or two bleeps to indicate a reading error. In the case of a reading error, the bar-code is re-read with the light pen. The bar-code label can include a check digit to detect errors.

A pre-programmable receiver can be microprocessor controlled and has to have some parts permanently powered (as with any timing device). For a portable receiver, a CMOS microprocessor and CMOS memory components would be desirable to minimise power consumption. The same microprocessor can handle the light-pen input without any significant increase in cost or average power consumption. The major additional cost is that of the light-pen itself, and in mass production this should be small since the only active components required are an LED and a phototransistor.

A problem with printing bar-codes in the broadcasting periodical or newspapers, is that the bar-codes take up considerable space and if printed too small would be liable to cause errors on reading by the light pen. An alternative system is therefore to over-print each programme item with its associated bar-code, using an "ink" which is invisible to the human eye but which can be detected by a suitable light-pen, e.g. one sensitive to ultra-violet radiation. Using this principle, fairly large bar-codes can be printed which would allow the use of existing coarse paper and low-resolution (low cost) light pens.

The choice of invisible printing "ink", its illumination or excitation and the form of light-pen, would need to be the subject of experiment. For example, it would be necessary to achieve adequate discrimination between the bars of the bar-code and the paper in-between, without interference from the normal printing. If ultra-violet excitation of a phosphor bar-code were used to cause fluoresence, the lens or optical receptor in the light-pen could be designed to pass the fluoresence from the bar-code and to stop the ultra-violet energy reflected from the printed paper base.

Code scanning systems comprising a light pen have been known for some time to input data to computing or pulse operated apparatus, see for example British Patent 1,389,014 which mentions the use of bar codes to produce telephone dialling pulses and U.S. Patent 3,735,350 which describes how a light pen can be used with a dotting pattern to provide data signals for a computer, a display, a typewriter, or a communication system, or for recording on a recorder. Hitherto, there has been no appreciation of the fact that the bar code and light pen provide the key to the problems of providing a pre-programming system for a radio or television receiver which is suitable for consumer use. To our knowledge, there has been no proposal of a receiver provided with a light pen by means of which information can be entered into it, nor any realization of the considerable advantages such a simple system provides. These advantages are particularly pertinent when used with broadcast signals which carry programme information, thus enabling the system to overcome many of the practical problems involved with pre-programming with minimum complexity in the system as seen by the user.

When used with a television receiver, the information entered could be used additionally for purposes other than station or programme identification, e.g. to programme a microprocessor used for video games.

A preferred system embodying the invention for use in a radio receiver will now be described with reference to the drawings, in which:

Figure 1 is a perspective view of the radio receiver showing a light pen in use to read programme information from a broadcasing periodical;

Figure 2 is a block circuit diagram of the receiver circuits used to pre-programme the receiver; and

Figure 3 shows a typical bar code.

The broadcast radio receiver 10 shown in Fig 1 is provided with a light pen or wand 12 by means of which information can be entered into it. The light pen can be held in the hand 14 of the user, and is applied along bar codes 16 (see also Fig 3) printed in a broadcasting periodical 18, e.g. the *"Radio Times"*.

Referring now to Fig 2, the circuit structure of the relevant receiver circuits is shown. The receiver 10 includes conventional radio receiver circuits 20 including at least an R.F. stage 22 and an A.F. stage 24 feeding a loudspeaker 26. The light pen 12 feeds a bar code analyser 28 which converts the pulses detached by the light pen into the processable information in the form of a train of characters or digits. In this example the bar code includes at least the following elements, namely a station identification code in the form of a station reference number, and a day/time code. The station reference number defines the station which it is desired to receive, e.g. BBC Radio 4. This may be transmitted on several different frequencies in different areas or in the same locality. Thus it is to be noted that the station reference number does not necessarily uniquely define the frequency or channel number of the desired transmission.

The day/time code may be defined to include also a week number. The code then uniquely defines the

intended or schedule start time for a programme. The code also preferably includes digits representing the programme duration. The code also preferably includes digits representing the programme duration. The code may also include a parity check digit.

The bar code analyser identifies the programme code being read and applies this to a programme store 30. In the programme store the codes read by the light pen are stored in a stack in order of the day/time code, i.e. the first or earliest programme is always at the top of the stack.

A clock circuit 32 looks at the code which is on the top of the stack. When the clock indicates that the next code is only five minutes away it causes the code to be outputted, the station reference number being applied to a frequency directory 34, and the day/time code, which may simply be termed the time code, being applied to a start time comparator 36. Simultaneously on ON/OFF circuit 38 activates the receiver R.F. circuits 22.

In the frequency directory 34 are listened all the frequencies on which each desired station is transmitted. Typically the selected station may be transmitted on three frequencies, and signals identifying these frequencies are then applied by lines 40 to a strongest signal detector 42. This detector operates as follows. The detector 42 is connected by a line 44 to the receiver R.F. circuits to control the receiver tuning. The detector 42 tunes the receiver successively to each of the possible transmission frequencies, and receives over a line 46 a signal representing the level of the broadcast signals received at each of those frequencies. The detector 42 then determines which is the signal of largest amplitude, and tunes the receiver permanently to this frequency.

The receiver is now prepared to receive the required programme. However, now a signalling decoder 48 comes into play. The broadcast radio signals are assumed to carry signalling information which indicates the channel and programme being transmitted. The signalling information may be carried on a subcarrier or may be carried by phase modulation of the main carrier. The detected time code is applied by the signalling decoder 48 to the start time comparator 36. The start time comparator 36 detects when the transmitted programme code is identical to the stored desired-programme code, indicating the start of the desired programme, and switches on or de-mutes the receiver A.F. circuits.

At the end of the desired programme, and so long as the next programme is not included in the programme store 30, the next programme code will be applied by the signalling decoder 48 to the comparator 36 to switch the receiver off.

The signalling decoder 48 is also connected to the frequency directory 34. This connection can be used for a number of purposes, examples of which are as follows. The signalling decoder 48 may load the frequency directory 34 with a channel code indicating the actual frequency or channel which has been found by the signal detector 42 to give the best reception. If the frequency directory 34 does not contain an entry for a particular desired station, then this can be determined as follows. The strongest signal detector 42 receives no possible frequencies from the director 34. It therefore causes the receiver tuning to sweep across its entire band. When a station is detected, the signalling code is detected by detector 48 and compared with the desired station code held in the frequency directory. If there is identity of station code, the frequency is then entered in the directory. In this way the frequency directory can be built up automatically. To improve the speed of response, the signal level is applied to a threshold device in the detector 42, which initially has a high threshold level. Thus on the first sweep across the receiver band only the most powerful stations are selected. If the desired station is not located, the threshold is lowered, and the sweep repeated. This process continues until the desired station is found. A line 58 from the signal detector 42 ensures that the signalling detector only loads the frequency directory 34 when the signal is of adequate strength.

This automatic tuning operation can be initiated by a separate manually operated push-button 50. This facility is particularly useful in a receiver mounted in a vehicle.

The frequency directory can be built up in other ways, for example by using the light pen 12 to scan an appropriate page of the broadcasting periodical.

When the programme which is selected is part of a series or course of programmes, means may be provided to re-enter the programme code for the next part of the series or course into the programme store 30. Preferably this is achieved by detecting a code at the end of each such programme, and applying this code from the signalling detector 48 by line 52 to the programme store 30.

Shown in Fig 2 is an audible or visual indicator 60 which may be actuated by the start time comparator 36. This indicates to the listener that his programme is about to commence. A push-button 62 is provided. If the user signals his presence by depression the push-button 62, then the receiver A.F. circuits are enabled, as described above. However, if the push-button 62 is not pressed the comparator 36 activates instead a recorder 64 which records the programme on tape.

The system described is particularly suitable for use with a receiver which can be operated by a remote control unit. The light pen 12 is then associated with the remote control unit.

If the bar codes in the broadcasting periodical include the programme duration, it is possible to determine as the information is fed into the programme store 30 when there is a conflict in the instructions. As shown in Fig 1, when the data is entered into the programme store 30 a display 54 on the receiver can give information concerning the selected programme to enable confirmation by the user. The selected frequency can also be shown on a frequency display 56.

The circuitry described and shown in Fig 2 may be replaced in large measure by a suitably-programmed microprocessor, in which case Fig 2 may be taken as an appropriate logic diagram or flow chart.

CLAIMS

1. A broadcast television or radio receiver, com-

prising means for causing the receiver tuning to be swept across a defined range, and means for detecting signals carried by received signalling signals and characteristic of the transmitting station.

2. A receiver according to claim 1, in which the received signals are applied to a threshold device, and the tuning is successively swept across the range, the threshold being successively reduced on each sweep until a desired station is detected.

3. A receiver according to claim 1 or 2, including means for storing the frequencies at which the received signalling signals are detected.

4. A broadcast television or radio receiver, including a store for storing desired programme information, means for providing an audible or visual indication of the commencement of an impending programme held in the store, and, in the absence of a manually-initiated confirmation signal, causing the programme to be recorded.

5. A broadcast television or radio receiver provided with a light pen and associated circuitry by means of which information can be entered into the receiver.

6. A receiver according to claim 5, in which the receiver includes a store, and the information from the light pen is entered into the store.

7. A receiver according to claim 6, in which the receiver includes means for detecting signalling signals received on a broadcast transmission, and for comparing the received signalling signals with stored signals.

8. A receiver according to claims 6 or 7, including means for providing an audible or visual indication of the commencement of an impending programme, and, in the absence of a manually-initiated confirmation signal, causing the programme to be recorded.

9. A receiver according to claim 6, 7 or 8, in which the information includes programme duration information.

10. A receiver according to any of claims 5 to 9, in which the information includes station identification information.

11. A receiver according to claim 10, in which the receiver includes a frequency directory correlating the station information with corresponding channel or frequency information.

12. A receiver according to claim 11, in which the receiver includes means for sequentially tuning the receiver to successive ones of the station frequencies, and means for detecting the frequency at which the strongest signal is detected.

13. A receiver according to claim 11 or 12, in which the receiver includes means for detecting signalling signals received on a broadcast transmission, and for entering channel or frequency information into the directory in response thereto.

14. A receiver according to any of claims 5 to 13, including means for causing the receiver tuning to be swept across a defined range, and means for detecting signals carried by received signalling signals and characteristic of the transmitting station.

15. A broadcast receiver substantially as herein described with reference to the drawings.

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